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Conestoga Television Association

Lancaster, Pennsylvania

Technical Report

THE ORIGINAL TRANSMITTER OF THE CONESTOGA TELEVISION ASSOCIATION

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When W3XDA (now W3XBR) first went on the air, March 23, 1946, relaying video signals from WPTZ, the 600 mc transmitter consisted of 2C43 tubes in grounded gird circuits (two as a push-pull RF amplifier – Fig. 1), plate modulated by the output of a resistance coupled amplifier which enabled transmitting 250 line resolution. To the latter, the video signal was in turn supplied by the output of a commercial RCA television receiver, first a TRK120 and later a 630TS set.

Modulator

The first modulator (Fig. 2) included three stages of voltage amplification, having a dc restorer in the grid circuit of the third stage and the plates of this stage directly coupled to the plates of the RF amplifier. This arrangement resulted in low plate voltage on the 2C43's and gave a maximum of about 30% modulation.

In an attempt to obtain a greater percent modulation, the modulator was slightly revamped to grid modulate the final 2C43 amplifier as shown in Fig. 3. This circuit, used from June 17, 1946 to September 15, 1946 consisted of two stages of voltage amplification and final cathode follower stage, working directly into the grids of the 2C43 amplifiers, where the dc restorer is located. This arrangement gave a useful modulation of approximately 50%.

In these modulators, wide band pass is obtained by use of small plate resistors in the 6AG7 and 6L6 stages. Since a bypass condenser across the bias resistor of the 6AG7 would have to be excessively large if it were not to discriminate against the low frequencies, it was omitted altogether. Although no difficulty was experienced with the common output resistor in the 6AS7G stage, parasitic oscillations, if observed, could be reduced by placing a 40Ω resistor in each plate lead instead of the common 20Ω.

Voice modulating the above equipment and receiving the signal on a receiver which had a filter added to eliminate frequencies above 10,000 ~ seemed to indicate that the 2C43 transmitter, when 100% plate modulated, would provide an adequate voice carrier for reception in Lancaster.

Oscillator and RF Amplifier

Construction details of the amplifier are shown in Fig. 4 and 5. In order to keep the grids at the same RF potential, the tubes were spaced as closely as possible. Plate and cathode line spacing was equal to that of the tubes. The use of the open wire line was advantageous in the plate circuit in keeping the capacity low and thereby obtaining maximum bandwidth.

The same diagrams serve to describe the oscillator, which differed only in having a feedback stub for each tube. The latter was a 2" long wire parallel and adjacent to the tube and connected to its cathode, with about 1" of the length projecting into the plate cavity.

The procedure for tuning the transmitter was as follows:

1) Disconnect output leads of oscillator, leaving loop in place.

2) Adjust plate shorting bar for resonance (minimum plate current). If circuit does not oscillate, move feedback stubs in closer to tubes.

3) Using wavemeter, adjust both plate and cathode bars for resonance at 600 mc.

4) Adjust condenser across output line as vernier.

5) Connect transmission line from oscillator to amplifier.

6) With antenna loop removed, tune amplifier in same manner as oscillator.

7) Recheck oscillator tuning and frequency.

8) Introduce antenna loop with antenna attached, noting whether it shifts the resonance frequency. If so, adjust impedance of antenna loop (or matching stub if one is used) until its reactive component is eliminated (by cut and try method), i.e., until introduction of the loop has no effect on resonant frequency.

9) If matching stub is used, adjust position of antenna lead until plate current at resonance is a maximum, or until maximum tube rating is reached.

When tuning had been completed, minimum plate current was about 15 ma at no load and 80 ma with load. Trouble was experienced with plate lead seals cracking on the 2C43 amplifiers. The plate line diameter was increased from 3/8” to 5/8” to provide better heat dissipation. A warning was received from the RCA-Harrison Engineering Department that, since firm contact between the plate lead and line was necessary for good thermal conduction, the remaining tube leads should not be rigidly connected or excessive strains across the tube would result. Since most of the tubes supplied us by Harrison had been life tested, a number of these were found to be too gassy for operation in this position; however, use of the standard product may make this selection unnecessary.

The resistors first used in the plate supply to these amplifiers (two 100Ω, 1 watt in parallel) burned out. A larger wattage resistor overheats, presumably from RF pickup. This difficulty might be overcome by using a choke coil and separating the plate supply lead from the housing by thin micas, to act as bypass condenser.

One possible improvement not attempted is the adjustment of line wire size-to-spacing ratio in order to obtain a high Q for stability in the oscillator circuit.

Initially, the antenna lead (300Ω twin lead) was brought to the loop with no attempt at matching impedances. Later a tuned stub was used, (as shown in Fig. 1 and 6, and described under 'Tuning Procedure', point 9) with a small improvement. No transformer was used between lead-in and the antenna, which was a folded dipole set in a corner reflector. A shield around the stub to minimize radiation might have been an improvement, but was not tried.

Conclusion

This transmitter, limited as it was in power (estimated at 3-4 watts average), gave useful signals over the 15 mile path from the Welsh Mountains to the Penthouse on the RCA Plant and other points in Lancaster city. These signals served to handle a variety of material required for tests, such as sound, picture and tone modulation. The transmitter enabled development of a transmitting antenna array (to be described in another report), and a converter; it permitted receiving antenna tests; it set a milestone along the CTA's path when it relayed the Louis-Conn fight into Lancaster on June 17, 1946.

It saw video service from March 23 to September 15, 1946, and will continue to operate, in modified form, as the club's sound transmitter.

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